



FL Phosphate Project - Study Plan Scoping Survey

Brad Jackson to: Derek Matory, Randall Chaffins

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Cc: Carol Monell, Jon Richards, Freda Lockhart, LaTonya Spencer, "Hawkins, Elaine"

From: Brad Jackson/R4/USEPA/US
To: Derek Matory/R4/USEPA/US@EPA, Randall Chaffins/R4/USEPA/US@EPA
Cc: Carol Monell/R4/USEPA/US@EPA, Jon Richards/R4/USEPA/US@EPA, Freda Lockhart/R4/USEPA/US@EPA, LaTonya Spencer/R4/USEPA/US@EPA, "Hawkins, Elaine" <HawkinRE@nv.doe.gov>

Attached is a document that I think is responsive to the request from the June 25 meeting. It sort of evolved as I prepared it. I first thought that it would be a formal WP, but then realized that a WP wasn't what may have been envisioned at the meeting, nor from a practicable standpoint was it feasible in the allotted time.

So, below is what I've titled a "Study Plan" for a Scoping Survey. Its 10pgs w/ figures and addresses the general goals, scope, methods, and costs. If approved, then I would have RSL prepare a formal WP and we would prepare a formal CI plan as well.

It has a few formatting issues, but I wanted to get it out today. I'm out 7/9-7/16 but will be checking email and will have phone access as well. I'll make revisions as soon as I receive them so that we can meet the 7/14 deadline. If needed, I could come in for a briefing next week.

Hope this is what's expected.

Thanks, Brad



scopingsurveywp1.docx

STUDY PLAN FOR SCOPING SURVEY

AERIAL RADIOLOGICAL ASSESSMENT

PHOSPHATE MINING-RELATED CERCLIS SITES IN

WEST-CENTRAL FLORIDA



July 2010

Prepared by EPA Region 4, Superfund Division
Atlanta, Georgia

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is initiating an investigation to evaluate radiological conditions at phosphate mine-related sites in EPA's CERCLIS database. A key component of this investigation is the assessment of potential gamma radiation exposures to individuals associated with formerly mined phosphate lands. The initial phase of the investigation will involve an aerial radiological survey to provide information on the nature and extent of gamma-emitting radioactive materials, both natural and anthropogenic. The extent of the 28 phosphate mine-related CERCLIS sites span an area approximately 350 square miles.

The first phase of this project includes a "Scoping Survey" of a limited area to 1) establish appropriate background levels; 2) calibrate aerial survey instruments with ground-based survey results; and 3) confirm survey methods and instrument capability in achieving the desired "Minimum Detectable Activity"¹ (MDA). These results will be used in the development of a Work Plan for the aerial radiological survey of all 28 phosphate mine-related CERCLIS sites.

This approach was developed at a June 25, 2010, meeting among EPA, the Florida Department of Environmental Protection (FDEP), the Florida Department of Health (FDOH), and the Agency for Toxic Substances and Disease Registry (ATSDR).

2.0 BACKGROUND

West-Central Florida is the location of the largest phosphate related industry in the United States. Phosphate ore is mined and processed at numerous mines spread over Polk, Hillsborough, Manatee, Sarasota, DeSoto, and Hardee Counties. The extent of the mineable limit of the phosphate deposits in these counties is approximately 2150 square miles (mi²). Most of the phosphate ore is used to produce agricultural related products, but is also used in the production of many other consumer products. Mining began in the late 19th century in Polk County, and continues to progress southwards.

Although there are numerous environmental issues associated with the phosphate mining industry, the U.S. Environmental Protection Agency (EPA) Region 4, Superfund Division, has focused on the evaluation of characterization, assessment, and mitigation approaches of potential risks associated with hazardous substances that may have been released during the mining and processing of the ore at the former mines. The primary contaminants believed to be associated with the mining wastes are radioactive isotopes. Naturally occurring levels of Radium 226 (Ra²²⁶) and Uranium 238 (U²³⁸) are

¹ The MDA is generally defined as the sensitivity of the measurement system in terms of the lowest level of radiation or radioactivity (e.g., exposure rate, equivalent soil concentration, etc.) that the system can reliably detect. The MDA for any radiation measurement system depends on several parameters, including the background count rate, the measurement time (count time) for data collection, the size of the sample being measured (e.g., surface area or volume) and the collection efficiency of the detector. When all of these parameters are known, it is possible to calculate an MDA in $\mu\text{R/hr}$ (for exposure rate), or pCi/g (for concentration) that can be used for survey planning and decision-making.

present in the ore, and when brought to the surface are redistributed at the surface during the mining and processing activities. It is believed that human exposure to elevated levels of radiation from formerly mined land may pose a potential health risk. Radionuclides redistributed through the mining process is referred to as Technically Enhanced Naturally Occurring Radioactive Material (TENORM).

2.0 OBJECTIVES

The objectives of this Scoping Survey are described below.

- 1) The first objective is to measure and evaluate ranges in background radiation levels. An appropriate background level will be established for comparison to radiation levels measured at phosphate mine related CERCLIS site.
- 2) The second objective is to calibrate aerial survey instruments with ground-based survey measurements.
- 3) The third objective is to confirm survey methods and instrument capability in achieving the desired MDA.

The extrapolation of these results to other CERCLIS sites and developed areas should be done with caution. Due to factors such as mine age, mining techniques, and the degree of reclamation, each mine area will need to be assessed on an individual basis. Using data from the Scoping Survey to infer the conditions as other mining sites could result in an “over-estimation” or “under-estimation” of radiological conditions at other sites.

3.0 SCOPE OF SURVEY

The Scoping Survey will include the measurement of radiation levels at three CERCLIS sites and six background locations in Hillsborough and Polk Counties, Florida. The locations and sizes of the survey areas are shown in Figure 1. The CERCLIS sites include the Tenoroc Mine Site located in Auburndale, Florida; the Brewster Lonesome Mine located in Bartow, Florida; and the Coronet Mine Site located in Plant City, Florida. The Tenoroc Mine and Brewster Lonesome Mine sites were selected primarily because of the limited development and ease of access due to State ownership.

The Coronet Mine Site was selected because of the significant amount of ground-based radiological data previously collected at the Site. The results from these areas will be used to help develop an appropriate correlation between the aerial and ground-based survey measurements. A ground-based survey was conducted over approximately 75% of the Coronet Site in March 2008.

FIGURE 1
AERIAL RADIATION SURVEY AREAS

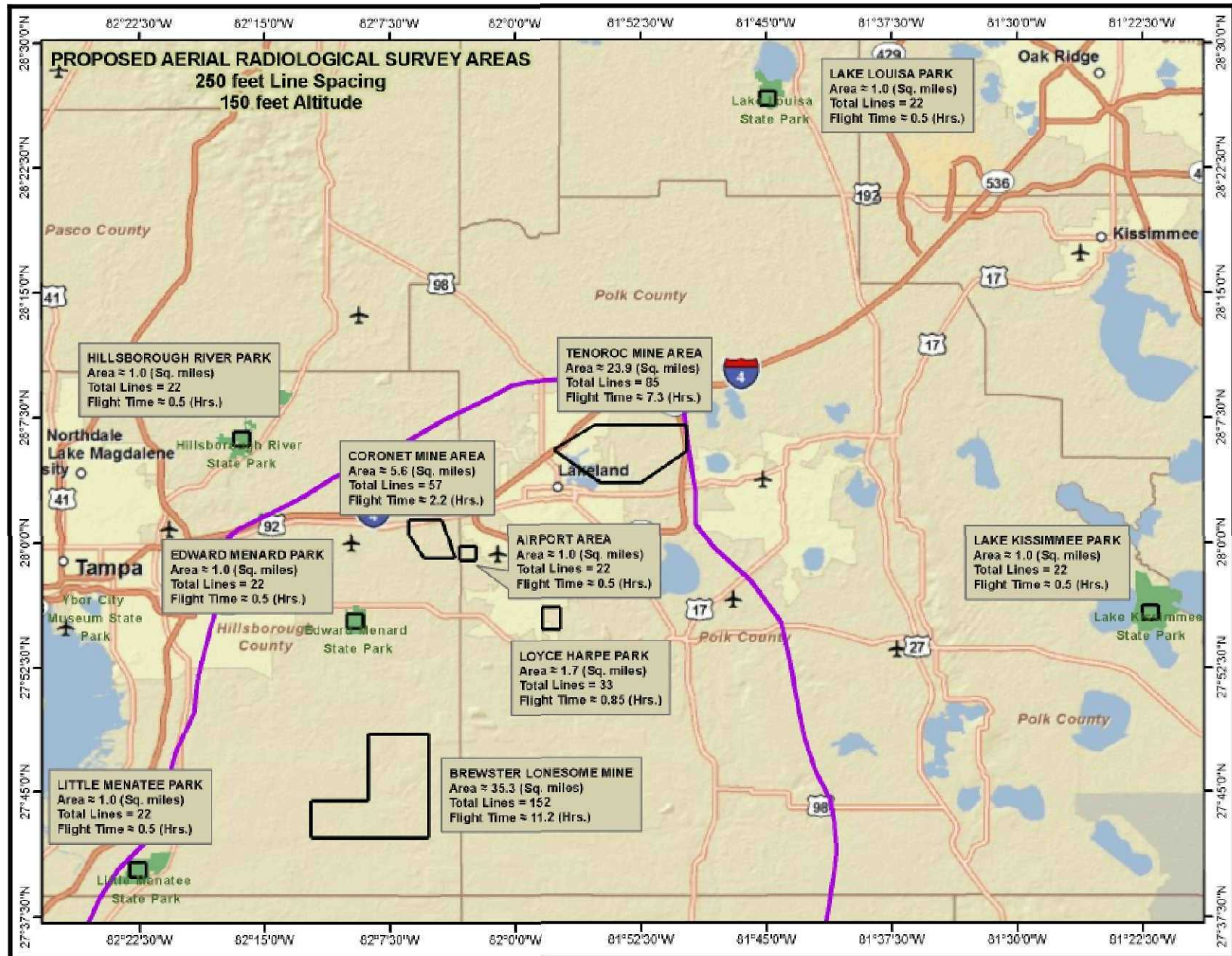


Figure 2 denotes the distribution of activities observed at the Site. Activity rates were also measured at the Lakeland Airport and the Loyce E. Harpe County Park for background and reference purposes, respectively. These areas will also be included in the scope of the aerial survey.

Three background locations were selected at locations overlying the phosphate deposit but that had not been mined to evaluate and establish an appropriate background level. Three additional locations were selected outside of the boundary of the phosphate deposit to evaluate the influence the deposit may have on background levels. The background locations are generally located at State parks because of the limited development and ease of access.

The survey areas total approximately 73 mi² in size. A formal Work Plan that addresses the objectives of this Scoping Survey Plan, detailing the objectives and scope of study, the methodology, project deliverables, and costs will be prepared by the Department of Energy (DOE), National Nuclear Security Administration (NNSA), Remote Sensing Laboratory. The Work Plan will be submitted to EPA for approval prior to the implementation of the study.

3.0 METHODOLOGY

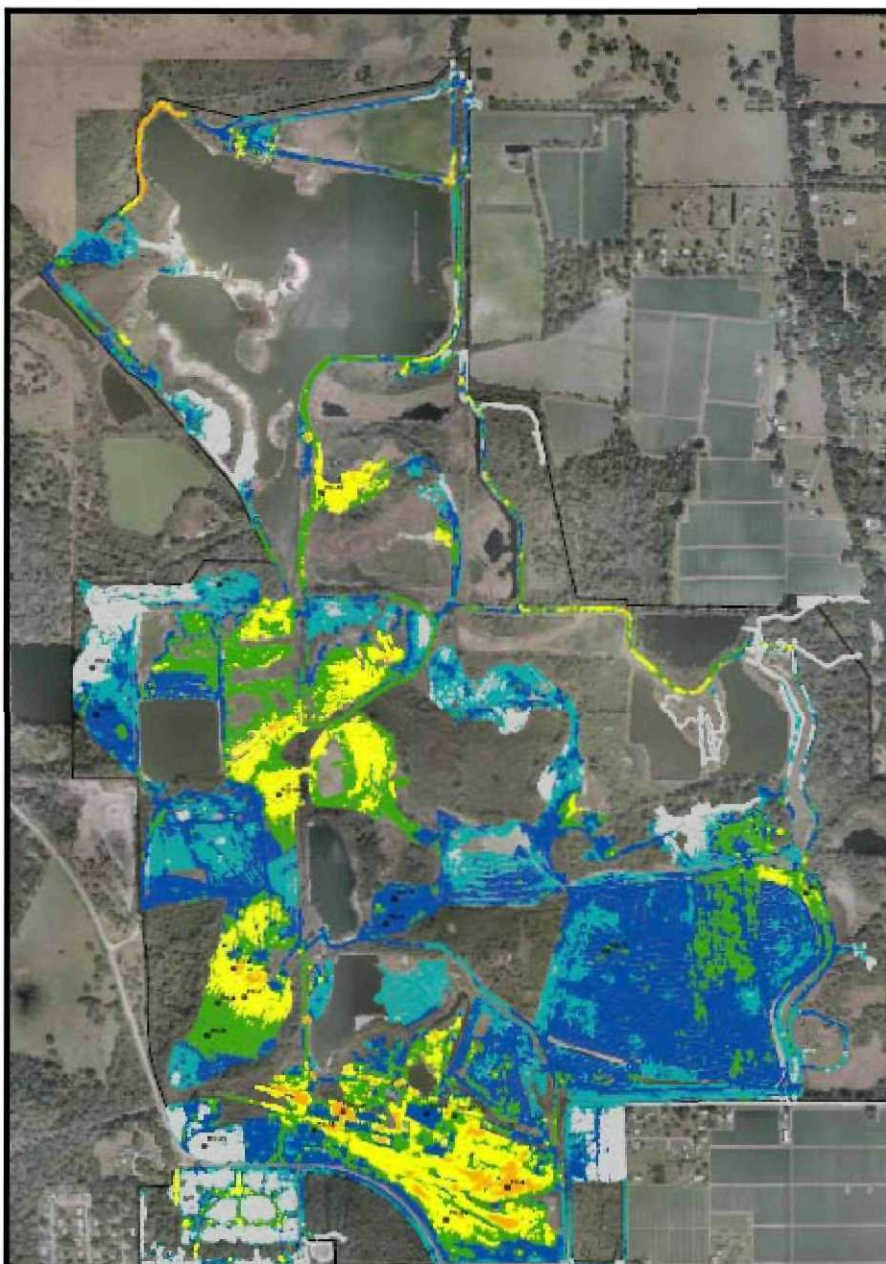
The investigation will include an aerial radiological survey to characterize gamma-emitting radioactive materials, both natural and anthropogenic. The survey will be performed using sodium iodide gamma radiation detectors mounted on a Bell 412 helicopter flown over the areas shown in Figure 1. The helicopter will fly a set of pre-planned flight paths over the study area at a height of 150-feet above ground level at a rate of approximately 90 miles per hour, and at 250-foot intervals. This survey concept is illustrated in Figure 3.

Figure 4 illustrates changes in the MDA with regard to survey height and the corresponding size of the area over which exposure rates are averaged. A survey height of 150-ft was identified at the optimal above ground level (AGL) for the survey because its expected to achieve an MDA as close to background as possible, while also flying at a safe altitude. At the Tenoroc Site, a limited area will be re-flown at an altitude of 100-ft and 300-ft AGL to evaluate changes in the MDA.

Measurements will be made using an array of thallium-activated sodium-iodide detectors mounted on the helicopter. Radiation levels will be made in one-second intervals and recorded on an onboard computer system. Signals from the detectors are routed into an analog-to-digital converter to produce the maximum sensitivity.



Helicopter flight positions during the survey will be continuously determined with a radar altimeter and a real-time differential global positioning system (RDGPS).

FIGURE 2
GROUND-BASED RADIATION SURVEY RESULTS MAP
CORONET INDUSTRIES, INC
PLANT CITY, FLORIDA



LEGEND

Gross Gamma Survey
Results (uR/hr), 1m
survey height

	< 10 uR/hr
	10 – 20 uR/hr
	20 – 40 uR/hr
	40 – 60 uR/hr
	60 – 80 uR/hr
	> 80 uR/hr

Scale:



FIGURE 3
AERIAL-BASED RADIATION SURVEY APPROACH

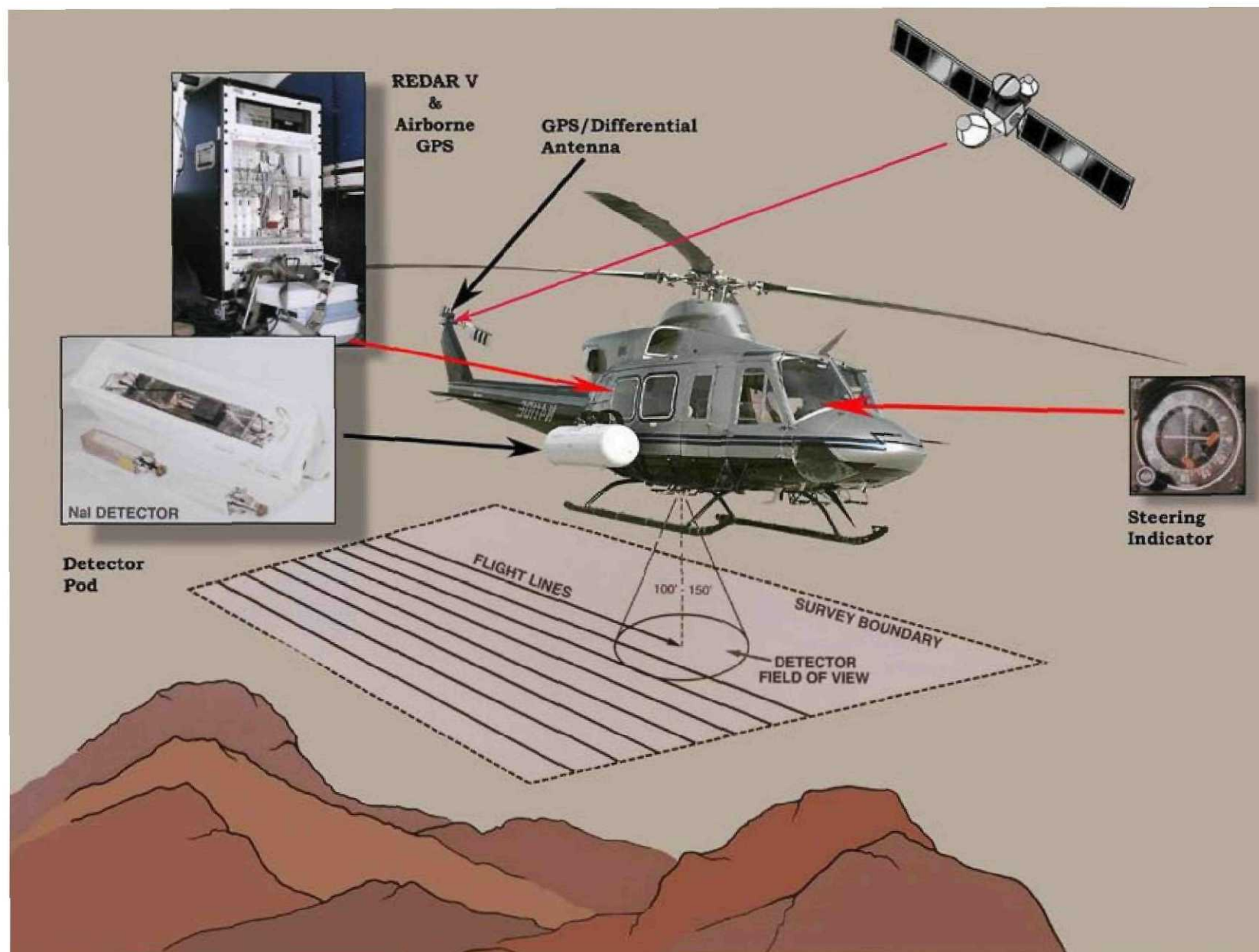
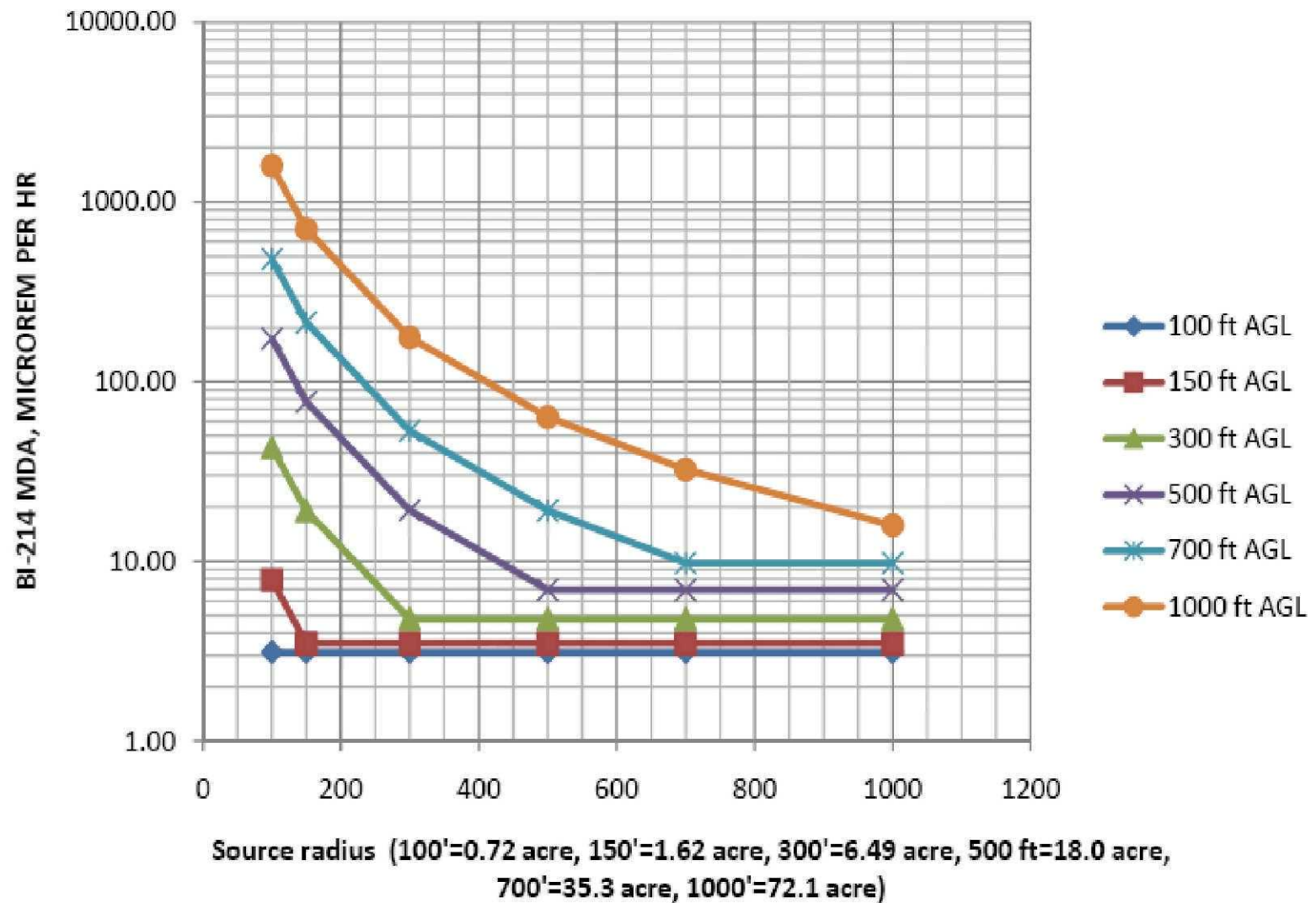


FIGURE 4
MINIMUM DETECTABLE ACTIVITY CURVE

12 DETECTOR, BI-214 MDA IN MICROREM PER HR



The RDGPS provides latitude and longitude position within an accuracy of approximately 5 meters. This data will be directed to the aircraft steering indicator and used to guide the aircraft along predetermined, parallel flight lines.

Fluctuations in atmospheric radon and cosmic radiation will be measured during each flight. These data will be used in subsequent data analyses to adjust the radiation measurements based on natural radon and cosmic radiation levels observed at the time of the survey. Air attenuation coefficients will also be calculated and adjustments made to the radiation measurements. Data from 2008 Coronet study will provide corroborative ground measurements for the aerial radiation results.

Aerial radiation measurements will also be made at multiple locations in proximity to the study area, which have not been affected by phosphate mining, in an effort to evaluate background radiological conditions for the area. An effort will be made to identify and account for interferences from man-made sources.

These results will be used to prepare a map that denotes total exposure rates for Ra^{226} .

4.0 COMMUNITY INVOLVEMENT

A formal communications strategy will be developed by EPA, in cooperation with FDEP, FDOH, and ATSDR, along with the preparation of the Scoping Survey Work Plan. A press release, fact sheet, and a summary of anticipated "Questions & Answers" will be developed as part of the communication strategy.

5.0 SCHEDULE

The following presents summary of proposed activities that are anticipated to be conducted prior to conducting the Scoping Survey, activities associated with the survey, and post-survey activities.

Pre-Survey Activities:

- August 2010: State and ATSDR concurrence on "Study Plan for Scoping Survey."
- Sept. 30, 2010: Draft Work Plan distributed for EPA, State, and ATSDR for review/comment.
- Sept. 30, 2010: Draft Communication Strategy distributed for EPA, State and ATSDR review.
- Nov. 30, 2010: Work Plan and Communications Strategy approved.
- Early- Dec. 2010: Conduct pre-flight reconnaissance and logistical activities.
- Dec. 31, 2010: Additional funding and IAG amendment completed.

Survey Activities:

- January 10, 2011: Press release and fact sheet issued.
- Jan. 24 – Feb. 19, 2011: Conduct aerial radiation survey.

Post-Survey Activities:

- March 21, 2011: Distribute draft report of survey results for review.
- Mid-April 2011: Meeting among EPA, State and ATSDR to discuss results and plan assessment of all phosphate mine-related CERCLIS sites.

6.0 ESTIMATED COST

The cost for the Pilot Study is estimated at approximately \$250,000. This includes approximately \$30,000 for project planning, work plan development, and pre-flight reconnaissance. The cost of the survey is estimated at approximately \$200,000, and the cost of reporting is estimated at \$20,000.